

BELLCOMM, INC.

1100 Seventeenth Street, N.W. Washington, D.C. 20036

SUBJECT: Trip Report - Preliminary Design
Review (PDR) of the S-IVB Workshop,
MSFC, May 8-10, 1967 - Case 600-3

DATE: June 13, 1967

FROM: D. J. Belz
A. N. Kontaratos
S. L. Penn

ABSTRACT

On May 8-10, 1967, a Preliminary Design Review of the S-IVB Workshop was held at MSFC. This memorandum outlines the activities of the Structures and Mechanics sub-board, the Ad-Hoc Thermal Design Review Group of that sub-board, and the Crew Station sub-board in which the authors participated.

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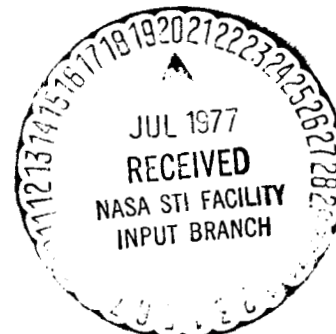
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MEMORANDUM FOR FILE

On May 8-10, 1967 a preliminary design review of the S-IVB Workshop was held at MSFC. The review was conducted by a sixteen-man board supported by sub-boards in the following functional areas:

1. Structures and Mechanics
2. Electrical Power Systems
3. Crew Station
4. Instrumentation and Communications
5. Manufacturing and Quality.

Bellcomm members of the sub-boards were D. J. Belz (Structures), A. N. Kontaratos (Crew Station), and R. L. Selden (Instrumentation). Mr. S. L. Penn participated as an alternate for Mr. Kontaratos on May 9, 10; Mr. W. Strack participated as an observer of the overall review board itself. This memorandum outlines the activities of the Structures and Mechanics (S&M) sub-board, the Ad Hoc Thermal Design Review Group of that sub-board and the Crew Station sub-board in which the authors participated.

Specific items on the agenda of the S&M sub-board included the meteoroid bumper, quick opening hatch, floor and crew quarters, thermal curtains, equipment mounting provisions, mobility aids, protective covers, fire-retardant liner, passivation provisions, vacuum outlet and provisions for sealing LH₂ tank outlets. Solar arrays, which are currently part of NASA Headquarters' baseline configuration for the Workshop, were not included in the preliminary design presented for review; inclusion of solar arrays will require modification of the meteoroid bumper design for structural compatibility.

A thermal analysis of the Workshop based on a 1350 node model was presented to the thermal review group. Anticipated interior temperatures, humidities, and gas velocities were compared with MSC crew comfort criteria. The orbital configuration chosen was a gravity-gradient stabilized vehicle in each of two

orbits corresponding to the extremes of exposure to solar heating during an orbital precession cycle. For both the hot and cold orbital extremes the MSC crew comfort criteria were exceeded. Estimates of makeup heater power requirements for the "cold" orbit were unrealistic in view of the poorly defined waste heat generation profile within the Workshop. The review group concluded that the present thermal control concept was feasible provided that one or more of the following remedial actions is taken:

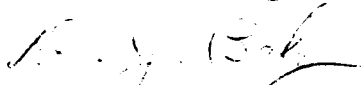
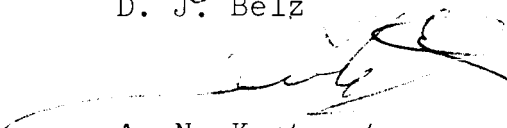
1. Relax MSC crew comfort criteria.
2. Establish Workshop crew timelines to "tailor" waste heat generation to thermal control requirements.
3. Provide makeup heat from electrical power during "cold" orbits while curtailing activities during "hot" orbits. (It was recognized that additional heater power does not presently appear to be available.)

Specific items on the agenda of the Crew Station sub-board included the sixty-eight action items generated during the astronaut "walk-through" the week before. In addition, members of this sub-board considered approximately one hundred additional items generated during the PDR itself.

Action items originated and supported by Bellcomm representatives in both sub-boards included recommendations for study of:

1. A meteoroid penetration warning system.
2. An emergency exit ("Blowout Patch") to free-space directly from the Workshop.
3. A fire detection/warning system and emergency breathing apparatus.
4. A hand-held thermal sensor for verification of Workshop component temperatures during activation.
5. Provision for an emergency cut-off of forced circulation in the event of fire.
6. A detection system for atmospheric contaminants in the Workshop.

The PDR as a whole did not result in approval of the Workshop preliminary design as presented by MSFC. The large number of recommended changes generated during the review will be referred to the AAP intercenter technical panels or other appropriate groups for consideration; it is anticipated that a PDR of the revised Workshop design will be scheduled after evaluation of those changes.


D. J. Belz
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S. L. Penn

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